

Pratt & Whitney
400 Main Street
East Hartford, CT 06108



30 November 1999

Mr. Jim Hookey
National Transportation Safety Board
490 L'Enfant Plaza East, SW
Washington, DC 20594

Re: PW4060 Low Oil Pressure Effect

Mr. Hookey,

The following information is provided to answer the Safety Board's question of 19 November 1999, in which Pratt & Whitney was asked to advise on the effect of low oil pressure, defined as 70psi (+/- 2psi), for a period of 16 seconds, on a PW4060 engine that was at idle power.

The Type Certificate Data Sheet E24NE identifies that the PW4060 engine model as conforming to operation with a temporary interruption of oil pressure associated with negative "G" operation for a period of 30 seconds maximum. For your reference, a copy of the Type Certificate Data Sheet is attached to this letter.

By conforming with the 30 second period of operation stated in the Type Certificate Data Sheet, operation of a PW4060 engine with low oil pressure for a period of 16 seconds should not have a significant effect on engine operation.

Please contact me should you have any further questions.

Best Regards,

Michael Bartron
Flight Safety Investigations

cc. M. L. Young - P&W

Appendix 7

| | | | |
|---|---|---|-----------------------------|
| U.S. DEPARTMENT OF TRANSPORTATION FEDERAL AVIATION ADMINISTRATION TYPE CERTIFICATE DATA SHEET E24NE | TCD: NUMBER E24NE REVISION: 7* DATE: DECEMBER 9, 1988 PRATT & WHITNEY MODELS: | | |
| | PW4050 PW4052 PW4058 PW4060 PW4060A PW4062 PW4060C | PW4152 PW4156 PW4156A PW4158 PW4160 | PW4460 PW4462 PW44650 |

Engines of models described herein conforming with this data sheet (which is part of Type Certificate Number E24NE) and other approved data on file with the Federal Aviation Administration, meet the minimum standards for use in certificated aircraft in accordance with pertinent aircraft data sheets and applicable portions of the Federal Aviation Regulations, provided they are installed, operated, and maintained as prescribed by the approved manufacturer's manuals and other approved instructions.

TYPE CERTIFICATE (TC) HOLDER: Pratt & Whitney Division
 United Technologies Corporation
 East Hartford, Connecticut 06103

TYPE

Axial airflow, dual-spool, turbofan, single-stage fan, 4-stage low-pressure compressor, 11-stage high pressure compressor, annular combustor, 2-stage high-pressure turbine, 4-stage low-pressure turbine.

RATINGS (See NOTE 5)

| MODEL | STATIC THRUST AT SEA LEVEL, LBS | |
|---------|---------------------------------|---|
| | MAXIMUM CONTINUOUS | TAKEOFF, DRY 5 MINUTES (SEE NOTE 13 & 21) |
| PW4050 | 48,120* | 60,000*** |
| PW4052 | 49,820* | 62,200*** |
| PW4058 | 49,530* | 58,750*** |
| PW4060 | 50,250* | 60,000*** |
| PW4060A | 50,250* | 61,570** |
| PW4152 | 49,200** | 62,000**** |
| PW4156 | 49,580** | 58,000** |
| PW4156A | 49,200** | 58,000**** |
| PW4158 | 49,580** | 58,000** |
| PW4160 | 49,600** | 60,000** |
| PW4460 | 51,050** | 60,000** |
| PW4062 | 50,250** | 62,000** |
| PW4462 | 51,050** | 62,000** |
| PW4060C | 50,250* | 60,000*** |
| PW4650 | 48,700* | 51,400**** |
| * | Flat-rated to 77°F/25°C | |
| ** | Flat-rated to 86°F/30°C | |
| *** | Flat-rated to 92°F/33°C | |
| **** | Flat-rated to 95°F/35°C | |
| ***** | Flat-rated to 108°F/42°C | |

★

| | | | | | | |
|------|---|---|---|---|---|---|
| PAGE | 1 | 2 | 3 | 4 | 5 | 6 |
| REV. | 6 | 6 | 6 | 6 | 4 | 7 |

LEGEND: "-" INDICATES "SAME AS PRECEDING MODEL"

"—" NOT APPLICABLE

NOTE: ALL PAGES ARE REFORMATTED. SIGNIFICANT CHANGES IF ANY, ARE BLACK-INKED IN THE LEFT MARGIN.

APPENDIX 7

TCDS E24NE

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COMPONENTS

Fuel Metering unit

Fuel pump and filter

Electronic engine control (EEC)

Ignition
Exciter
Ignitors

EEC alternator
Configuration 1 Stator
 Rotor

or, Configuration 2 Stator
 Rotor

Fuel distribution valve
Station 2.5 bleed actuator
Stator vane actuator
PT2/TT2 probe

PRINCIPAL DIMENSIONS (inches)
Length
Nominal diameter
Maximum radial projection

Hamilton Standard Model Number M/N JFC131-2

Argo-Tech M/N 711000, 71880C, 721000, 720100, 720300: Applicable to engine models rated at 61,570 lbs. takeoff thrust and lower. Argo-Tech M/N 722100, 825500: Applicable to all engine models.

Hamilton Standard M/N EEC131-1

Bendix or Unison Industries (PV/ P/N 50T241)
Auburn or Champion (PW P/N 709520 IC, 5005007-01)

Bendix or A/R Research L.A. Division P/N 10-621920-1 & -2
A/R Research L.A. Division P/N 91454685-1 & -2
Bendix or A/R Research L.A. Division P/N 10-621595-2

A/R Research L.A. Division P/N 2110540-1
A/R Research L.A. Division P/N 2104420-1

Hamilton Standard M/N GTA40-1
Hamilton Standard M/N GTA42-2
Hamilton Standard M/N GTA41-1
Rosemount P/N 154ED

153.6
97.5
52.8

WEIGHT (DRY)

9,420 POUNDS

Weight of basic engine includes all essential accessories, but excludes starter, exhaust nozzle, and power source for the ignition system.

CENTER OF GRAVITY (IN)

Axial: Engine station
Vertical: Relative to engine
Lateral: Relative to centerline

| | |
|--|---|
| PW4060/4052/4056/4050/4080A /4062/4080C | PW4152/4156/4156A/4158/4160A 460/4462/4850 |
| 9.4 ± 1.0 | -- |
| 0.7 ± 0.5 | 0.8 ± 0.5 |
| 0.1 ± 0.5 | 0.1 ± 0.5 left |

FUEL

See NOTE 10

OIL

See NOTE 11

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CERTIFICATION BASIS

FAR 33 effective February 1, 1985, as amended by 33-1 through 33-9, and Amendment 33-10 for FARs 33.71.14/23/27/77/88/90/92/94

Type Certificate Number E24NE

| MODEL | APPLICATION | ISSUED |
|---------|--------------|--------------|
| PW4056 | OCT 26, 1983 | JUL 09, 1986 |
| PW4156 | OCT 26, 1983 | JUL 09, 1986 |
| PW4152 | APR 01, 1986 | JUL 09, 1986 |
| PW4052 | JUL 09, 1987 | OCT 13, 1987 |
| PW4060 | JUN 04, 1987 | OCT 21, 1988 |
| PW4160 | JUN 04, 1987 | OCT 21, 1988 |
| PW4460 | JUN 04, 1987 | OCT 21, 1988 |
| PW4158 | JUL 23, 1987 | APR 29, 1988 |
| PW4060 | FEB 24, 1989 | OCT 12, 1989 |
| PW4060A | JUN 26, 1989 | MAR 30, 1990 |
| PW4156A | MAR 02, 1990 | AUG 06, 1991 |
| PW4062 | MAY 04, 1989 | JAN 21, 1992 |
| PW4462 | MAY 04, 1989 | JAN 21, 1992 |
| PW4060C | JUL 22, 1992 | SEP 24, 1992 |
| PW4650 | FEB 24, 1995 | MAR 03, 1995 |

PW4256: APPLICATION OCT 26, 1983 / ADDED JUL 09, 1989 / DELETED SEP 25, 1986

PRODUCTION BASIS (All Models)

Production Certificate Number :1

NOTES

NOTE 1.

Low pressure rotor
N1, RPM)

High pressure rotor
N2, RPM)

| MAXIMUM PERMISSIBLE OPERATING SPEEDS FOR ENGINE ROTORS (ALSO SEE NOTE 1) | | |
|--|---|--------|
| PW4050/PW4052/PW4152 | PW4056/PW4060/PW4060A/PW4060C/PW4156/PW4156A/PW4158/PW4160/PW4460/PW4462/PW4650 | PW4062 |
| 4,012 | 4,012 | 10,044 |
| 10,300 | 10,450 | 10,450 |

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NOTE 2.

| MAXIMUM PERMISSIBLE TEMPERATURES | | | |
|---|-------------------|-------------------|--|
| For in-flight starts which result in exceedance of the ground start limit, the maximum temperature and duration must be recorded for maintenance action, the PW4000 Maintenance Manual. | | | |
| External engine component maximum in-flight temperatures are specified in the Installation and Operating Manual, Section 4.3. | | | |
| MODELS PW 4050 | MODELS PW 4052 | MODELS PW 4152 | MODELS PW 4056/4156/4156 V 4156/4080/4080 V 4160/4480/4082 4482/4080C/48E3 |
| Turbine exhaust gas temperature | | | |
| At takeoff (5 min. see NOTE 21) | 625°C/1157°F | 640°C/1184°F | 640°C/1184°F |
| Max. continuous | 600°C/1112°F | 625°C/1157°F | 615°C/1139°F |
| At start-up | | | |
| Ground | 535°C/995°F | -- | -- |
| In-flight | 625°C/1157°F | 640°C/1184°F | 650°C/1202°F |
| Oil outlet temperature | | | |
| Continuous operation | 163°C/325°F | -- | -- |
| Transient operation* | 177°C/350°F | -- | -- |
| *Transient operation above 163°C/325°F is limited to 20 minutes. | | | |

NOTE 3.

FUEL PRESSURE LIMITS:

At inlet to engine system pump, not less than 5 psig above the true vapor pressure of the fuel and not greater than 70 psig with a vapor/liquid ratio of zero.

OIL PRESSURE LIMITS:

Minimum

70 psid

Temporary interruption of oil pressure associated with negative "G" operation is limited to 30 seconds maximum. Normal oil pressure will be restored rapidly once the negative "G" effect has been eliminated. There is no maximum oil pressure limit.

NOTE 4.

MAXIMUM PERMISSIBLE AIR BLEED:

8TH STAGE BLEED

NORMAL MAXIMUM

| | | |
|------------------------------------|-----|-----|
| Idle to 40% Maximum Continuous | 0.0 | 0.0 |
| 40% Maximum Continuous to Takeoff: | 6.0 | 3.0 |

15TH STAGE BLEED

| | | |
|------------------------------------|------|------|
| Idle to 40% Maximum Continuous | 12.0 | 12.0 |
| 40% Maximum Continuous to Takeoff: | 1.6 | 1.6 |

NOTE 5.

The Sea Level Static Ratings are ideal and are based on ICAO Standard Atmosphere conditions, a Pratt & Whitney hardwall bellmouth inlet, no fan or compressor air bleed or load on accessory drives, an exhaust system having no internal pressure or external scrubbing losses, an inlet duct and primary nozzle velocity coefficients equal to 1.0.

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P/GE 5

NOTE 6.

The following accessory drive provisions are incorporated:

DRIVE

High pressure rotor
Starter
IDGS
Fluid power pump (R)
Auxiliary fluid power
pump

| ROTATION | SPEED RATIO TO TURBINE SHAFT | TORQUE (lb-in) | | | C/W RHANG (lb-in) |
|----------|---------------------------------|----------------|--------|----------|----------------------|
| | | CONTINUOUS | STATIC | OVERLOAD | |
| CCW | 0.841:1 | — | — | — | 500 |
| CCW | 0.841:1 | — | 12,820 | — | 1,000 |
| CCW | 0.388:1 | 1,300 | 6,500 | 1,950*** | 400 |
| CCW | 0.379:1 | 1,300 | 6,500 | 1,950*** | 400 |

LEGEND: CCW = counterclockwise

* Maximum starter torque = 910 lb-ft at zero rpm and 1,250 lb-ft maximum impact torque. Maximum allowable starter torque value is 1,498 lb-ft.

** maximum allowable continuous torque values are equivalent to 175 horsepower at any engine speed at or above sea level idle. The following overload conditions can be accommodated:

| HORSEPOWER | DURATION TIME | RECURRING TIME |
|------------|---------------|----------------|
| 225 | 5 minutes | 1,000 hours |
| 225 | 5 seconds | 1 hour |
| 450 | 5 seconds | 1,000 hours |

*** Maximum allowable for 5-minute duration recurring at four hour intervals minimum.

NOTE 7.

Power setting, power checks, and control of engine output in all operations are to be based upon Pratt & Whitney engine charts referring to either turbine discharge section gas pressure or low rotor speed. Pressure probes and a low rotor speed sensor are included in the engine assembly for this reason.

NOTE 8.

For inflight operation during icing conditions, the minimum allowable fan speed (N1) is 23% (720 rpm).

NOTE 9.

Lightning protection requirements and electromagnetic interference omitted by the electronic engine control system, including cables, are specified in the Installation and Operating Manual, Section 4.12.

NOTE 10.

Fuel and fuel additives conforming to the latest applicable issue of FAA-approved Pratt & Whitney Turbojet Engine Service Bulletin No. 2016 may be used separately or mixed in any proportions without adversely affecting the engine operation or power output.

NOTE 11.

The following oils are eligible: Oils conforming to Pratt & Whitney Turbojet Engine Service Bulletin No. 238, latest revision.

NOTE 12.

Certain engine parts are life-limited. Limits are listed in Pratt & Whitney PW4000 Turbofan Engine Manuals, Part Nos. 50A443, 50A605 and 50A822, Time Limit Section.

NOTE 13.

The engines meet the January 1, 1984, smoke and gaseous emission requirements of SFAR 27. The same requirements are now incorporated into Federal Aviation Regulation Part 34, effective September 10, 1990.

NOTE 14.

The engines meet the January 1, 1975, fuel venting emission requirements of SFAR 27. The same requirements are now incorporated into Federal Aviation Regulation Part 34, effective September 10, 1990.

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- NOTE 15. The maximum permissible engine inlet distortion limit is specified in the Installation and Operating Manual, Section 4.4, Report PWA-6049.
- NOTE 16. Limits regarding transient rotor shaft overspeed rpm and transient gas overtemperature and the number of overtemperature occurrences are specified in the Maintenance Documents, Part Nos. 50A444, 50A606, and 50A823.
- NOTE 17. Information regarding approved fuel filter and oil filter replacement parts is in the PW4000 Series Illustrated Parts Catalogs, Part Nos. 50A145, 50A607, and 50A824.
- NOTE 18. Requirements and limitations associated with automatic fuel system anti-icing are specified in the Installation and Operating Manual, section 4.5, Report PWA-6049.
- NOTE 19. The PW4000 series engines have been approved to operate with certain faults present in the control system, based on satisfaction of FAR 33 requirements and appropriate FAR 25 control system reliability requirements. The following criteria exist as dispatch and maintenance requirements for the engine control system. These criteria are specified in Pratt & Whitney Report PWA-6139 and PWA-6139 Addendum, which defines the various configurations and maximum operating intervals as follows:
- | | |
|----------------|--|
| Fault Level A: | No dispatch allowed |
| Fault Level B: | Dispatchable; maximum operating interval for Fault level B fault(s) is 20 days. |
| Fault Level C: | Dispatchable; maximum operating interval for Fault level C is 1000 operating hours |
- Review of EEC fault data from only the most recent flight leg is sufficient at the 1000 hour interval except for the following EEC part numbers: P&W P/N 50D791, 50D824, 51D037, 50D823, 51D319, 51D686.
- Fault Levels A, B, and C constitute Pratt & Whitney nomenclature. The airframe manufacturers may use different nomenclature in adapting these fault categories to the aircraft maintenance and display systems. However, the maximum operating intervals are restricted as shown above.
- A control system reliability monitoring program has been established with Pratt & Whitney in compliance with the reporting requirements as outlined in the Engine and Propeller Directorate Policy letter dated October 28, 1993, for Time Limited Dispatch of Engines fitted with FADEC Systems.
- NOTE 20. Incorporation of Pratt & Whitney Service Bulletin PW4ENG 79-43 provides an alternative means of compliance with the requirements of FAR 33.71(c)(1).
- NOTE 21. The normal 5 minute takeoff time limit may be extended to 10 minutes for engine out contingency.
- NOTE 22. Engines in which Engineering Change Number EC92KK322G, H, I, J, and K were incorporated during manufacture are designated by a (-3) on the Engine Data Plate.

—END—

APPENDIX 7